

# Assessing the Factors that Influence the Career Choices of Minority PhD Graduates in SEM Fields

Danyell Wilson, PhD, Anne Donnelly, PhD

University of Florida, *South East Alliance for Graduate Education and the Professoriate (SEAGEP) Program*. 206 Particle Science and Technology Building Gainesville FL 32611

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Professoriate preparation programs have become widely available and are designed to address the need to increase diversity among faculty in science, technology, engineering and math (SEM) fields. This paper examines the factors that influenced the career decisions of a group of minority SEM PhD graduates who participated in a professoriate preparation program while attending a research intensive institute for their graduate studies. Quantitative data were collected via phone and face-to-face interviews with the alumni participants. In spite of participation in the program, a number of them did not choose to directly enter an academic field. Factors that influenced the career choices of these students were the tenure track process, life style, and salary among others. The participants who entered academic careers, stated that working with students, conducting independent research, and obtaining positions in higher education leadership affected their decision to go into the professoriate.

## Introduction

The numbers of underrepresented minority (URM) students earning a PhD in science, engineering, and mathematics (SEM) has increased gradually over the past 10 years, however the diversity of SEM faculty remains low (Burns et al. 2009). According to a recent report by the National Academy of Science this increase in URM representation in SEM fields is vital to diversifying the research workforce (Council 2005). They believe that a diverse workforce enables Americans to stay at the forefront of scientific innovations (Council 2005). Therefore, a variety of programs have been prepared to train students for the professoriate; most notably The Preparing Future Faculty program funded by the Pew Charitable Trusts and Howard University's Preparing Future Faculty program (Hoffer and Selfa 2001; Monastersky 2007; Fox and Stephan 2001). One national program designed to prepare students for academic careers is the National Science Foundation's Alliance for Graduate Education in the Professoriate (AGEP) Program. The goal of this project is to increase the number of domestic students receiving doctoral degrees and prepare them for academic careers in SEM fields, with a special emphasis on URM students which include Blacks, Hispanics, Native Americans, and Pacific Islanders. This goal is achieved by developing an infrastructure that substantially changes the graduate school experience for URM students thereby catalyzing institutional change. AGEP was established in 1997 and to date consist of 21 Alliances that represent over 80 institutions.

A number of studies have been conducted analyzing the factors that influence the career choices of undergraduate students in science and engineering (Lopatto 2004; Villarejo et al. 2008). These factors include the social demographics (race, family economic income) of a student, the structural characteristics of the institution attended during college, and the individual's experience during college (Villarejo et al. 2008). To date little research has been conducted to study the factors that affect the career trajectories of graduate students. Surveys have been designed to report the labor market outcomes of recent SEM doctorate holders (Hoffer and Selfa 2001). In 1973, NSF developed a biennial survey entitled the Survey of Doctorate Recipients as part of the Science Resources Studies (SRS) project (Hoffer and Selfa 2001). This instrument has been used to document the employment of persons who received their PhD at an American institution and follow them throughout their career (Fox and Stephan 2001; Hoffer and Selfa 2001). Social scientists have compared the job expectations of graduate students to the actual employment of recent graduates based on the survey by SRS (Fox and Stephan 2001). Economists and educational policy makers have developed "knowledge-based" models examining how postgraduate educational funding affects the development of an individual's scientific career ((Gaughan and Robin 2004; Villarejo et al. 2008); while other studies and reports have analyzed how the state of the economy has affected the career options of young researchers (Council 2005; Monastersky 2007; Laudel and Glaser 2008). The goal of the current project was to determine what if any of these factors influenced the career choices of a group of young researchers in a professorate training program.

In 1998 the University of Florida was awarded the AGEP grant and five years later they invited Clemson University and the University of South Carolina to join the project, creating the South East AGEP (SEAGEP). SEAGEP now consists of the University of Florida as the home institute, Clemson University, and the University of South Carolina as primary partners. The impact of this program is apparent since the University of Florida is now the fourth-highest producer of Hispanic PhD graduates in engineering and the third highest PhD granting institution producing African American PhD graduates in engineering. Given that one of the goals of this program is to prepare future faculty, SEAGEP researchers conducted a study to determine the factors that influenced the career choices of their doctorate alumni.

### Methodology

A telephone survey with both Likert scale and open ended questions was developed and administered to SEAGEP alumni from the University of Florida. Forty two of UF SEAGEP alumni were emailed and invited to participate in the survey. Twenty nine out of the 42 responded for a 69% participation rate. All of the interviews were tape recorded and the tapes were coded and analyzed by the interviewer. Interview, lasted between 10-20 minutes.

Highlighted in this report are the quantitative results obtained from the study. The Likert scale questions differed according to the career position of the participant. All participants were asked to rank the following factors:

- Research
- Working with Students
- Salary
- Location
- Life style
- Other

Those that were already in academic positions or post-docs that expressed an interest in pursuing a career in academia were also asked to rank the following factors:

- Opportunities for Higher Education Leadership
- Independent Research

Participants that were in industry, government, or post-docs that expressed an interest in pursuing a non academic career were asked to range the influence of the following factors on their career decision:

- Undergraduate Debt
- Graduate Debt

These scholars were also asked to range the importance of the following possible reasons for not entering an academic track:

- Research
- The Tenure Track process
- Proposal and Grant writing
- Other

The ranking scale was 1 through 5 with 5 being the most important as seen below:

1. Not important at all
2. Not an issue
3. Somewhat Important
4. Important
5. Very Important

## Results

### Demographics of Participants

To date the University of Florida's SEAGEP has graduated 42 PhDs who now hold positions in either Academia, Industry or Government. Twenty nine alumni took part in an interview

addressing the different factors that affected their career choices. Four of the alumni who did not participate in the interviews are working in industry, while two are pursuing careers in academia and two are currently in post-doc positions. The remaining are unaccounted for. The demographics of the participants are found in Table 1. Twenty of the participants were Black, while 9 were Hispanic. There were 15 males and 14 females. The 14 engineering scholars were from material science and engineering, aerospace, biomedical, or mechanical engineering. The 7 participants with degrees in biological sciences were in the fields of microbiology, entomology, animal science, virology, and biochemistry. The 6 graduates in the physical sciences were from chemistry, soil and water science, astronomy, and geology. The majority of the participants were currently in post doctoral positions with the next largest group working with the government. Four of the doctorates are assistant professors and two are adjunct professors. Lastly, four of the scholars are working in industry.

Participants were categorized according to their current positions as either in academia, industry, government, or post-doctorate position. Since the post-doctorate position is an entry level and temporary position, fellows currently in postdoc positions were asked what was going to be their next career move. According to the response of this questions, they were subcategorized into either academia, industry, or government.

Table 1. Demographic Information of the Interviewees

Field of Study	Total number of Participants	Black	Hispanic	Post-doc	Industry	Academia	Government
Engineering	15	13	2	6	3	2	3
Biological Sciences	7	4	3	2	0	3	2
Physical Sciences	6	3	3	4	1	0	1
Mathematics	1	0	1	0	0	1	0

## Academia

A total of 13 participants expressed an interest in engaging in an academia career. Six are currently in teaching positions and seven are presently holding post-doc positions. Figure 1 is a summary of the average ranking of the importance of various factors that influenced the career choices of this group of scholars. Results indicated that the ability to work with students was the highest ranked factor that influenced the career goals of these participants. Conducting independent research was the second highest ranked factor followed by life style. Most of the participants were asked to explain why they preferred the academic life style over nonacademic and they replied academia provides more freedom than industry, and it moves at a slower pace. Location and salary were two of the lowest ranked factors that influenced the career decisions of the these scholars.

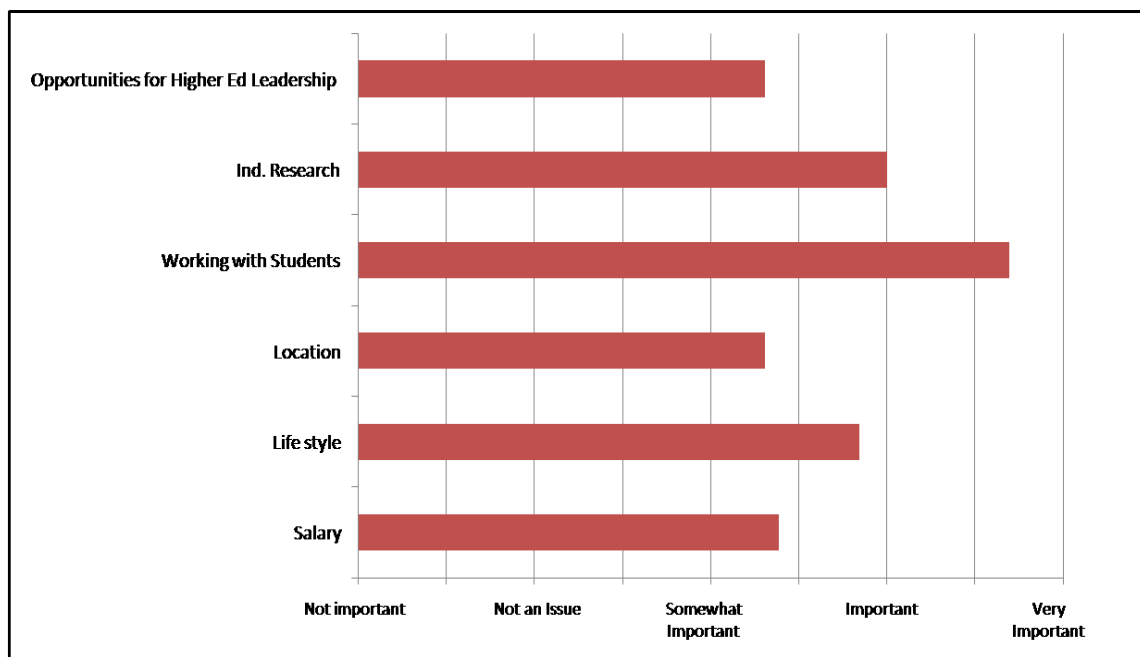


Figure 1. Factors that influence the career decisions of 13 SEAGEP participants currently or aspiring to a career in academia.

#### Nonacademic

The survey that was given to the nonacademic interviewees incorporated questions that addressed economic issues of the participants. This addition to the survey was based on the widely known assumption that industry offers more money to young researchers. Therefore, undergraduate and graduate student debt were added to the list of factors that could influence the career selection. Unexpectedly, these issues were less than “somewhat important” on the career choices for industry and just above somewhat important for government scholars as shown in Figure 2. The most important factor for students that entered industry or have an interest in the private sector was salary, followed by life style. Currently there are only four SEAGEP alumni that were interviewed in industry positions conducting research and three post-doctorates interested in a career path in the private sector.

The nine participants that are currently working for the government either conducting research as permanent staff or post docs, serving as unit supervisors, or working in patent law, ranked life style as the most important factor that influenced their career decision. This group found that working for the government was the best of both worlds: the stress to publish, obtain tenure, and write grants was not an issue, and the stress associated with producing a product that in industry was also not an issue. Hence, life style ranked highest for the government employees followed by salary, and then undergraduate student debt.

Nonacademic doctorates were also asked to rank to the importance of working with students and conducting research on their career decision. Two indicated their career choice was based on a preference not to work with students. Of the eight who rated working with students positively, they still chose a nonacademic career. Of the eight who ranked working with students important but are in nonacademic careers, five have identified opportunities to working with students. When they were asked about research, 8 indicated that research was important to them, while 6 indicated it was not an issue. Two of the nonacademic interviewees stated it was one of the reasons they did not chose a career in academia.

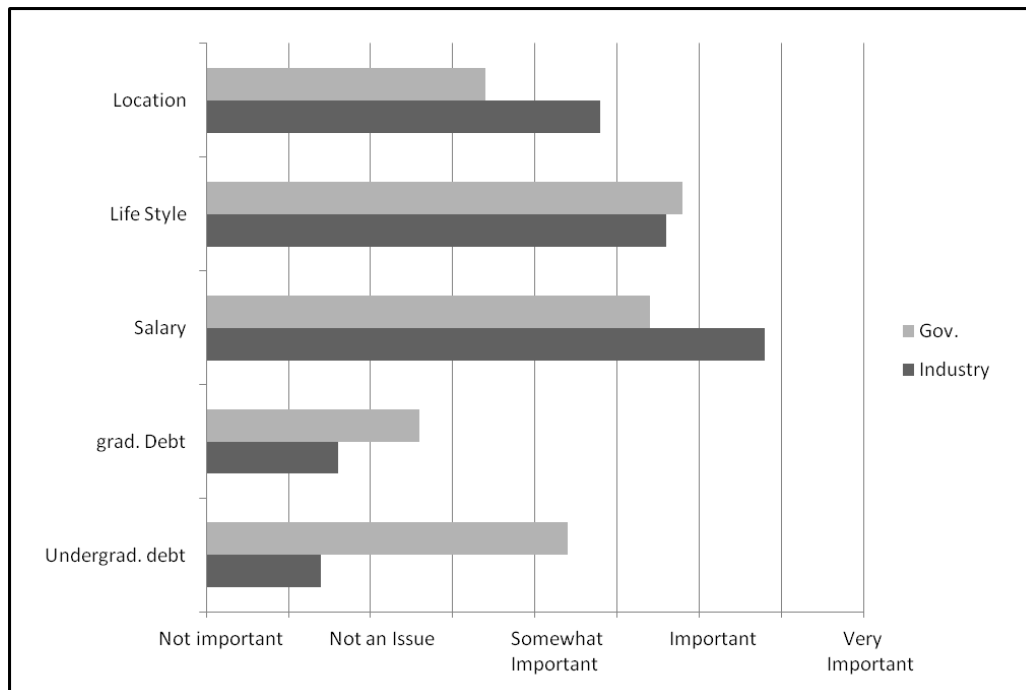


Figure 2. Factors that influence the career decision of 16 SEAGEP doctorates in either post-doc, industry, or government positions.

Nonacademic doctorates were also asked to address some issues that might have steered them away from an academic career path. These included the tenure track process and grant/proposal writing which can be shown in Figure 3. Both of these issues were ranked somewhat important for those students in government.

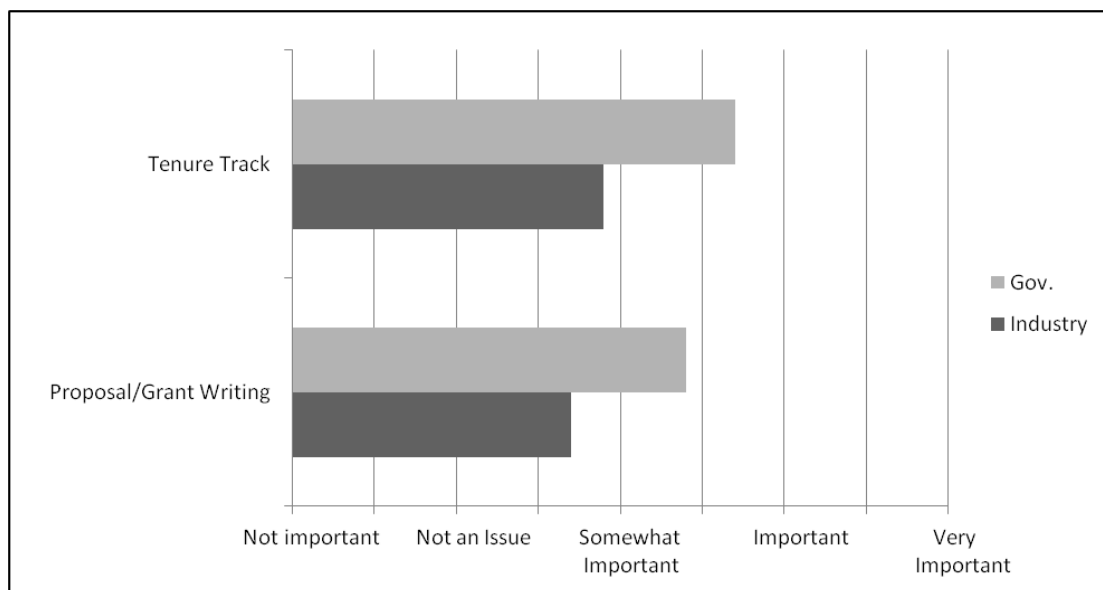


Figure 3. Possible factors that could have discouraged the SEAGEP alumni from a career in academia.

### Responses Based on Gender

The career choices of the men versus that of the women can also be determined from this data. The majority of men interviewed in this study chose careers in academia or are currently in post-doc positions (10 out of the 15). The other 5 men chose careers in either industry or government. Eight of the women interviewed were in academia or postdoc positions (Table 2). Six of the women were in industry positions or working with the government. It is interesting to note that presently five of the six faculty members are men as shown in Table 2.

Table 2. Career Choice of Male and Female Participants

Field of Study	Total number of Males	Post-doc	Academia	Industry	Government
Engineering	6	2	2	1	1
Biological Sciences	5	1	2	0	2
Physical Sciences	3	2	0	1	0
Mathematics	1	0	1	0	0
<b>Total number of Females</b>					
Engineering	8	4	0	2	2
Biological Sciences	2	0	1	0	1
Physical Sciences	3	2	0	0	1

### Discussion

This study examined the factors and issues that affected the career choices of 29 graduates from a professoriate preparation program in the SEM fields at a research intensive institution. This program provided professoriate training in the form of funding, professional development workshops, travel awards, and post doctoral training. The success of the program is indicated

by the total number of PhDs that have graduated within the last 11 years. Of the 42 students, 15 are currently pursuing academic careers and 13 of them participated in this interview. The highest ranked factor for pursuing this career choice is the working with students and secondly to conduct independent research. The lowest ranked factor was location; which is the participants are located throughout the United States.

Out of the six doctorates working as professors, two are at research intensive universities while the rest are at either 4 year colleges or universities. These findings support the studies conducted by NSF's Survey of Doctoral Recipients. They found that Blacks and Hispanics are more likely to teach at 4 year colleges or university among all other races/ethnic groups (Burrelli 2006; Hoffer and Selfa 2001). They are not likely to teach in research intensive institutions (Burrelli 2006). Post-doctorates respondents that expressed an interest in the professoriate should be tracked for the next ten years to evaluate this possible trend and determine if the SEAGEP program affected their ultimate career placement in academia. This is important because some academic positions are requiring applicants to have applied and successfully received research grants and have an outstanding publication record (Laudel and Glaser 2008; Horta 2009). These requirements are extending the time spent in post-doc positions, which can have a negative effect on young researchers (Monastersky 2007; Laudel and Glaser 2008). Negative post-doc experiences can arise or family issues may occur that could cause a need for a higher salary and a transition into a nonacademic career path (Monastersky 2007; Moguerou 2004). Both of these issues were stated by three of the six post-doctorates participants that were interviewed and interested in nonacademic careers.

Salary and life style were ranked as the most important career influences for nonacademic participants. Industry and government are known to offer more money and benefits to young researchers (Hoffer and Selfa 2001). Therefore, this response was not surprising for young researchers who are starting families or have certain restrictions in their mobility due to their family. Historically, out of the majority of full-time working scientists, US citizens are more likely to enter careers in industry or government in comparison to international PhDs who are more likely to go into postdoctoral positions and industry (Hoffer and Selfa 2001). Some of our participants actually had a preference for the traditional academic route, but were unable to obtain a position due to the state of the economy. Fifty-six percent of the nonacademic participants stated they want to eventually pursue a career in academia. Some of the participants were on temporary appointments that were at one time advertised as a tenure track position. Two of the interviewees were in industry and government because they could not find a postdoc in their area of research interest. Nevertheless, their passion to work students motivated them to develop innovative ways of partnering with local schools to continue and work with students.

It is interesting to note that lifestyle ranked 3.84 for participants interested in academia, 3.86 for those interested in industry, and 3.89 for those that were interested in government positions. While this study did not address the overall satisfaction with career choice, these values indicate that for all groups lifestyle was an important factor. Respondents clearly held specific perceptions of the life styles offered by the three different career choices and chose the one that most closely matched their personal preference. This is consistence with a pervious study that analyzed the roll of academic field and gender on career preferences (Fox 2001).



While programs like the AGEP program prepare students to enter academia, lack of appropriate postdoc and entry-level opportunities made it impossible for some to do so. Others were faced with economic and family concerns that made employment in the non-academic sector more attractive. In all cases however the support and training received by students who participated in these types of programs serve them well in whatever career path they chose. Seventy-two percent of the students stated that the training, networking, funding, professional development, and overall support from the AGEP program was a vital component for the completion of their graduate degree.

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